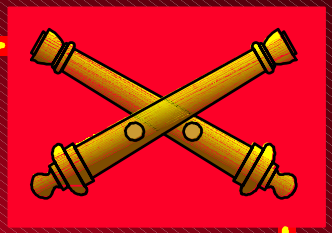
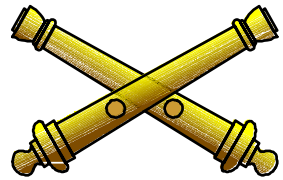
GUNNERY DEPARTMENT

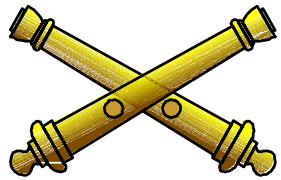


THE KING OF BATTLE

USAFAS

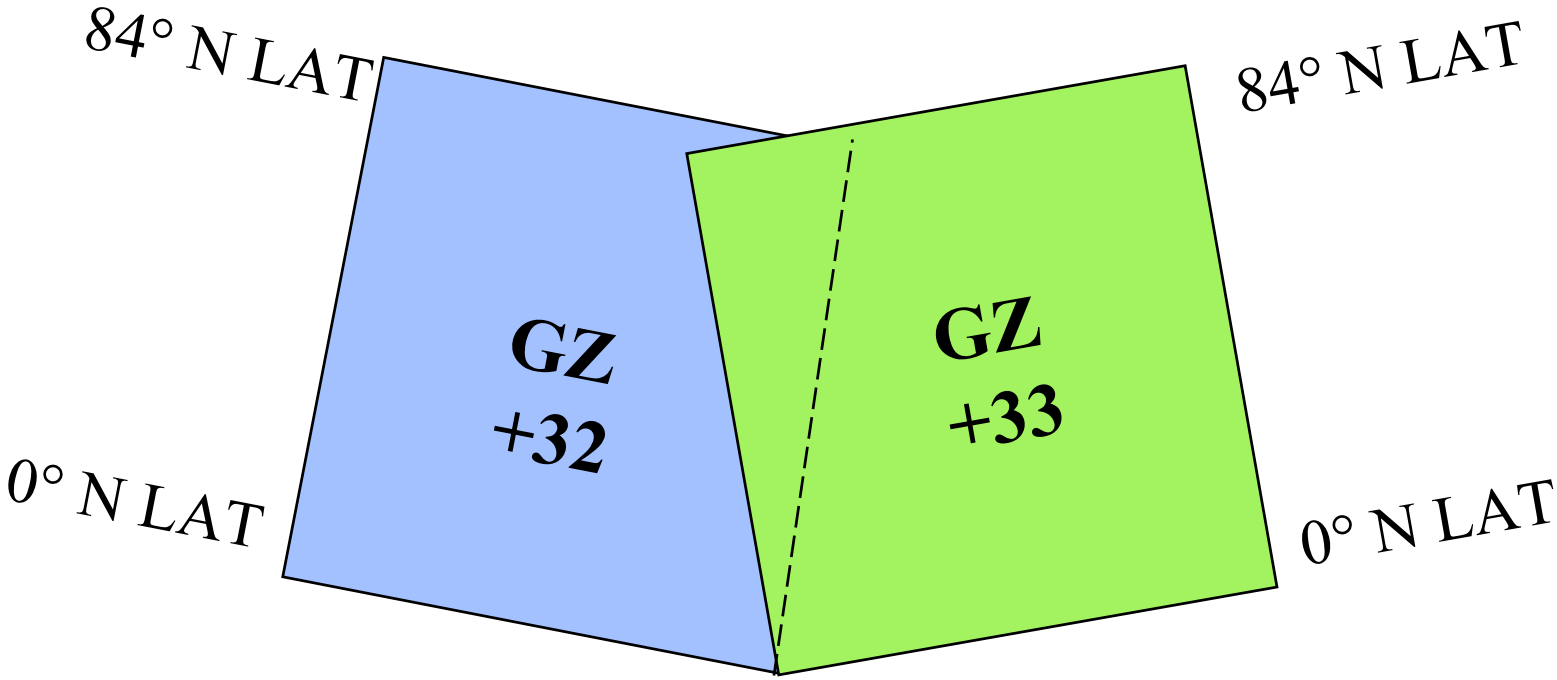


BCS SPECIAL SITUATIONS



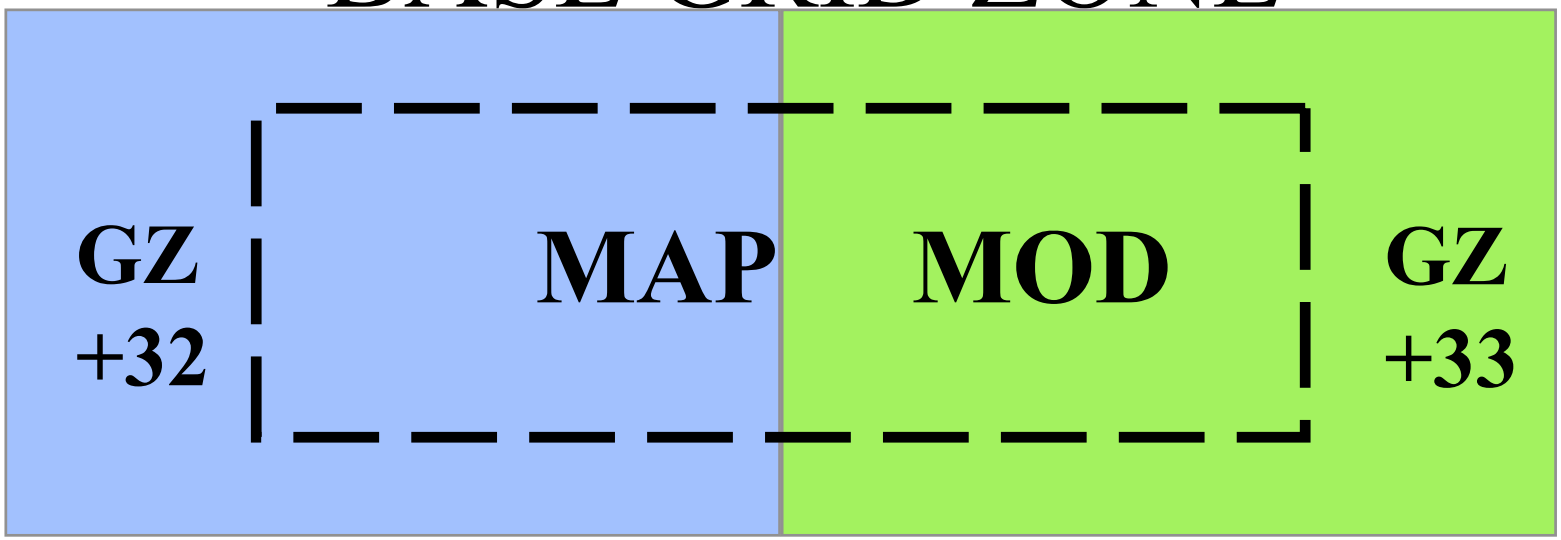
ZONE TO ZONE TRANSFORMATION

WHY ZONE TO ZONE TRANSFORMATION



- GRID ZONES ARE NOT PARALLEL
- GRID LINES IN ADJACENT ZONES ARE NOT PARALLEL

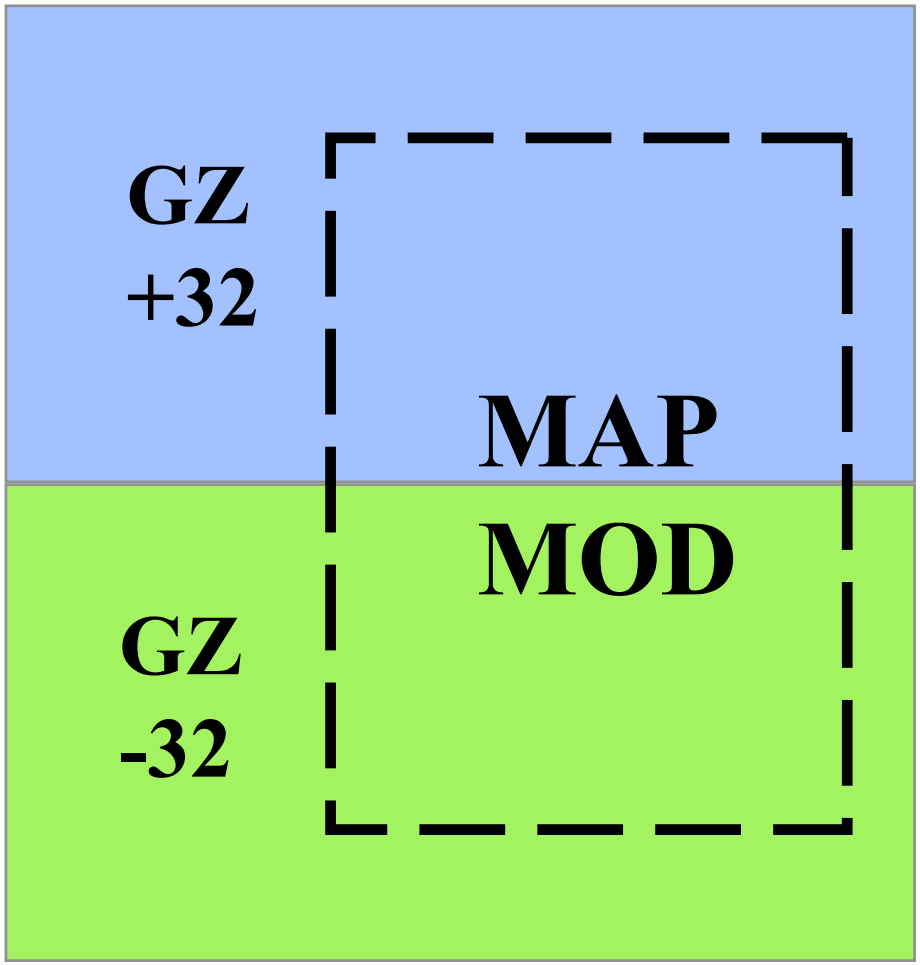
DETERMINATION OF BASE GRID ZONE



MAP MOD STRADDLING AN NORTH-SOUTH GZ BOUNDARY-BASE GZ WESTERN-MOST

- BASE GZ +32

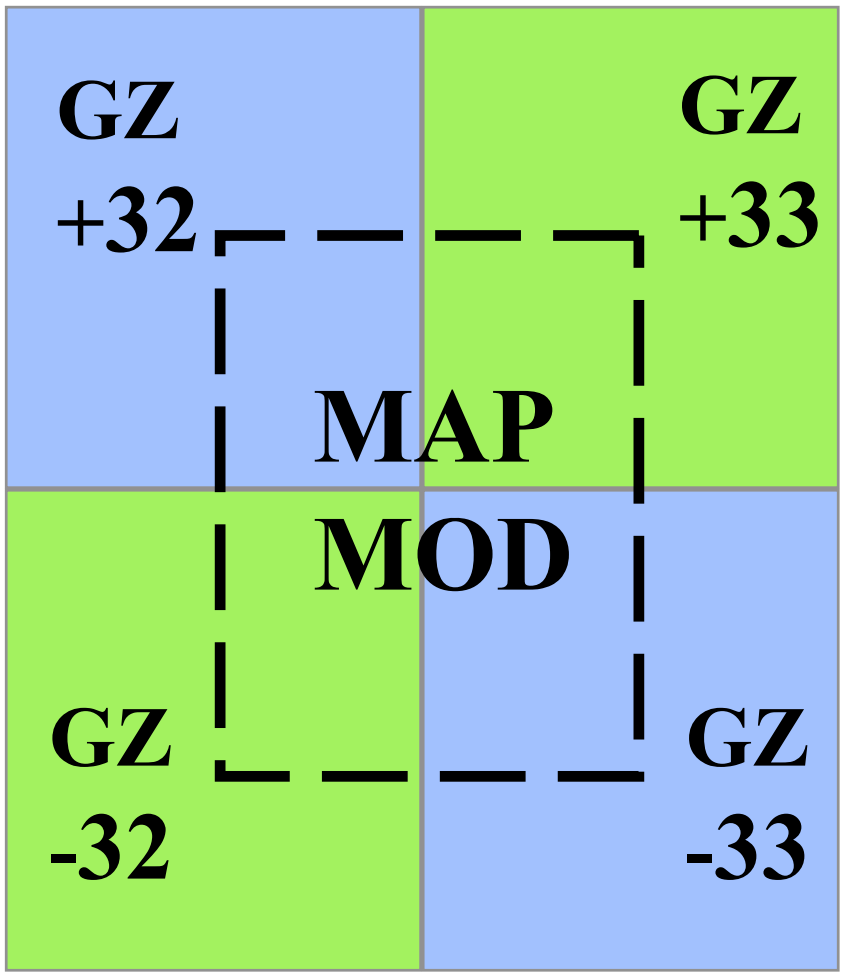
DETERMINATION OF BASE GRID ZONE



MAP MOD STRADDLING EQUATOR BOUNDARY - BASE GZ SOUTHERNMOST

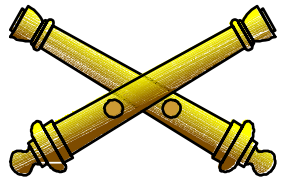
- BASE GZ -32

DETERMINATION OF BASE GRID ZONE



MAP MOD STRADDLING EQUATOR AND NORTH/SOUTH GZ BOUNDARY - BASE GZ SOUTHWESTERN MOST

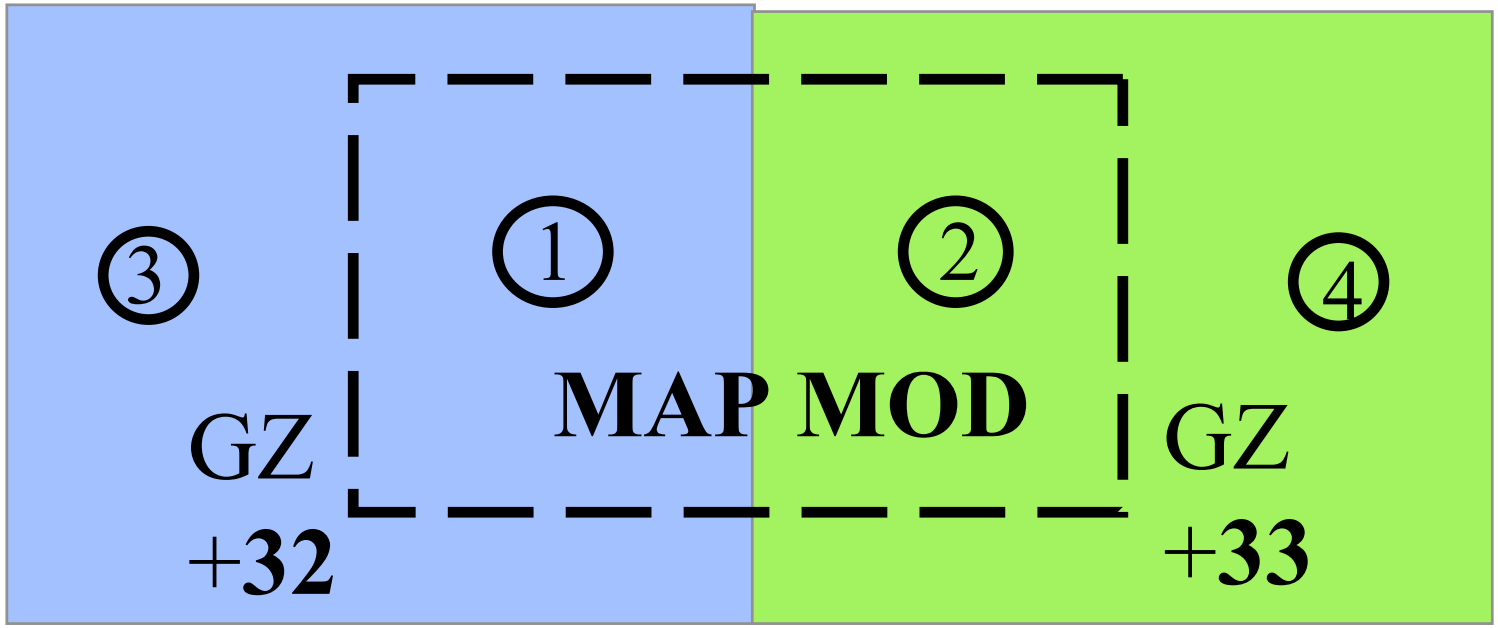
- BASE GZ -32



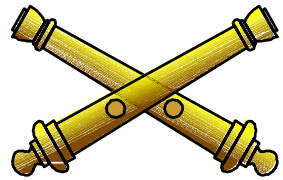
DETERMINATION OF BASE GRID ZONE

- BASIC RULE -
  BASE GRID ZONE IS ALWAYS THE SOUTHWESTERN CORNER OF MAP MOD.

BASE GRID ZONE PE

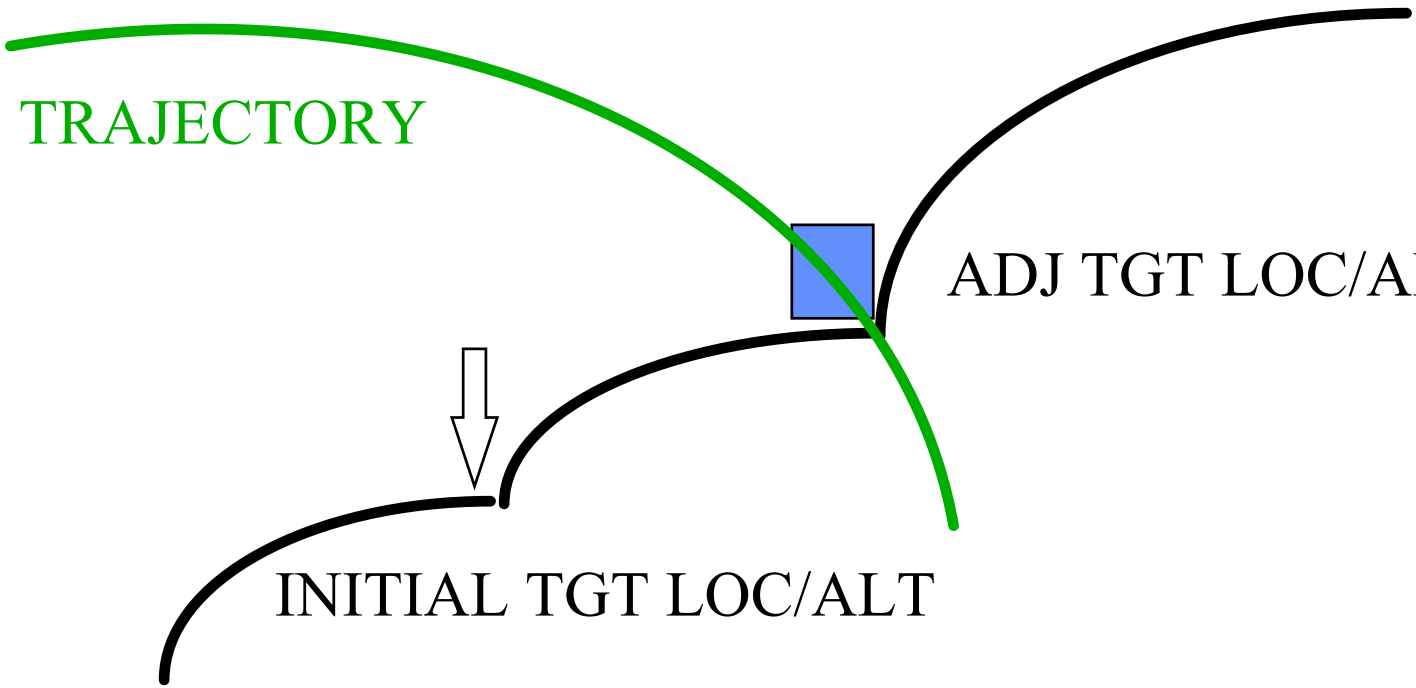


SITUATION	MAPMOD	BASE GZ	CORD	GZ REQ'D
1	Y	Y	5 X 5	N
2	Y	N	5 X 5	Y
3	N	Y	6 X 8	N
4	N	N	6 X 8	Y



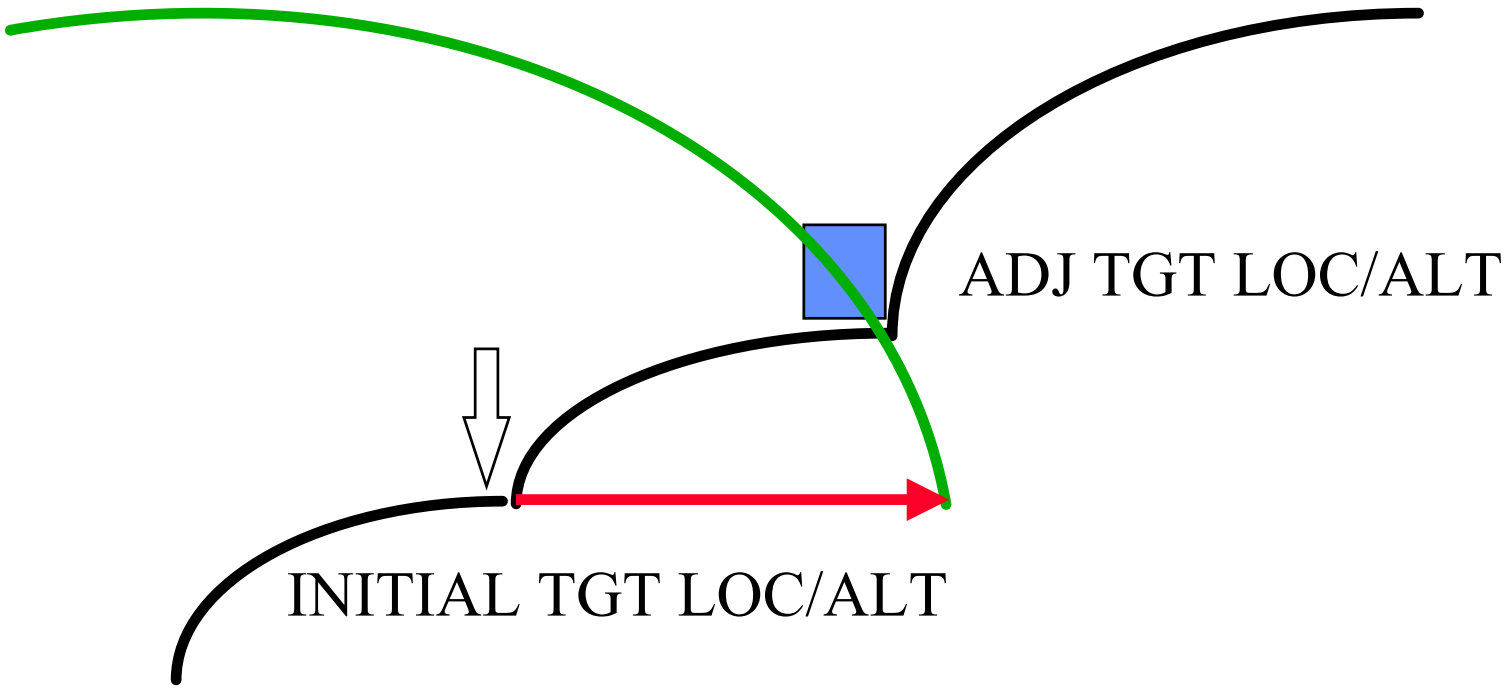
REPLOT

REPLOT



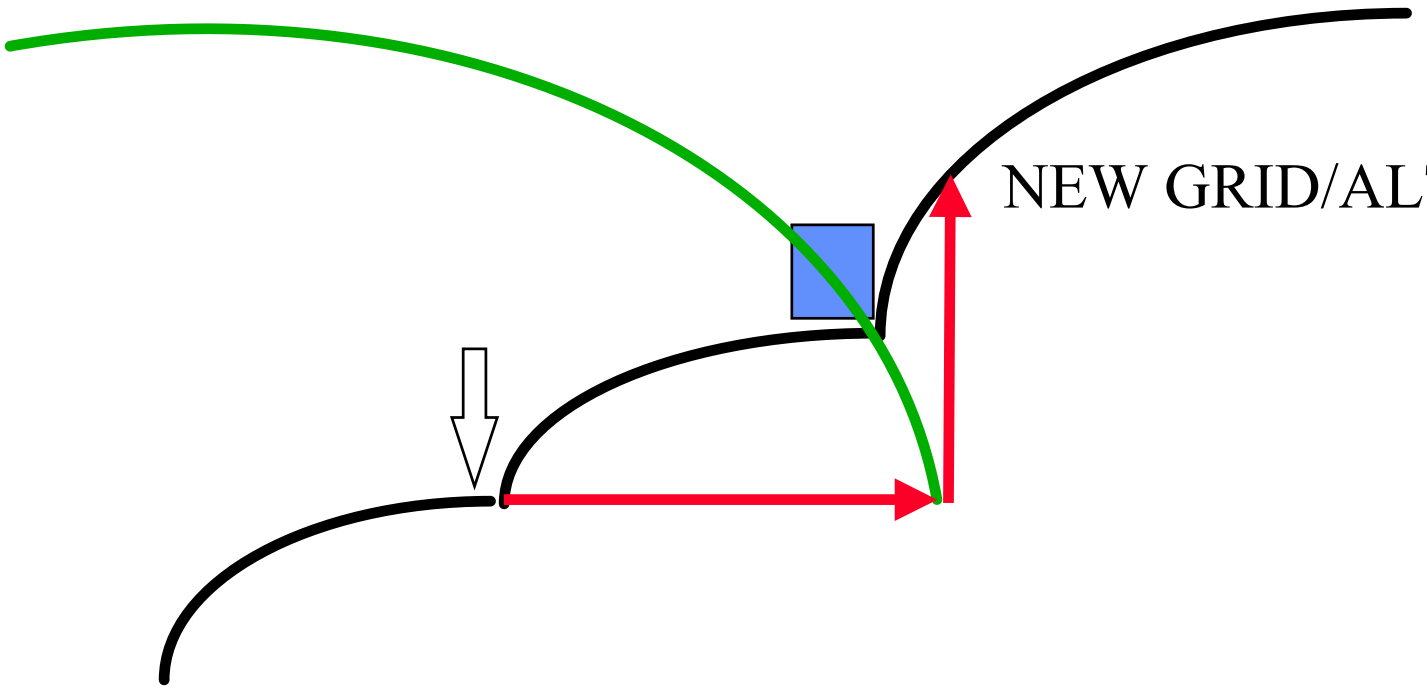
- OBS TRANSMITS REFINEMENT AND RECORD AS TGT
- ACTUAL TGT ALTITUDE, AND LOCATION NOT ACCURATE

REPLOT



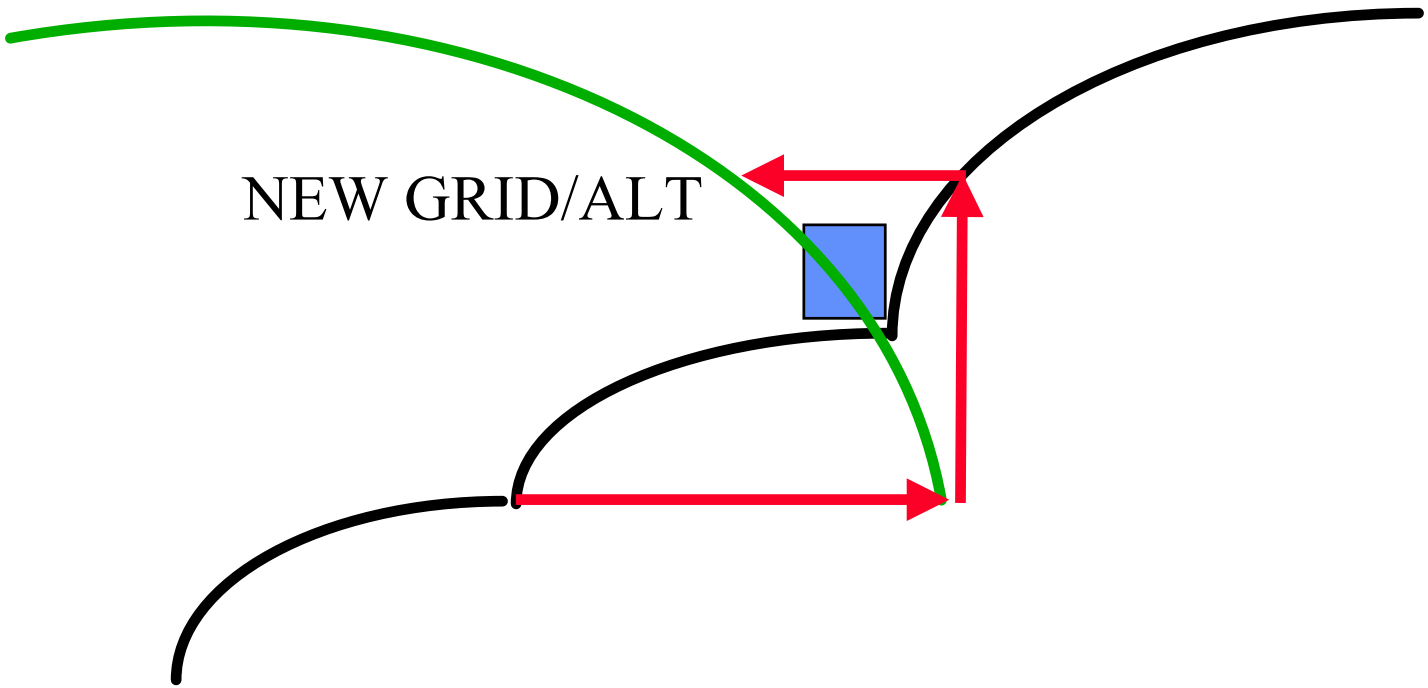
- TGT MUST BE ALONG TRAJECTORY
- COMPUTER ASSUMES ALTITUDE IS UNCHANGED FROM INITIAL CFF
- THE DETERMINED GRID IS AT INITIAL ALT

REPLOT



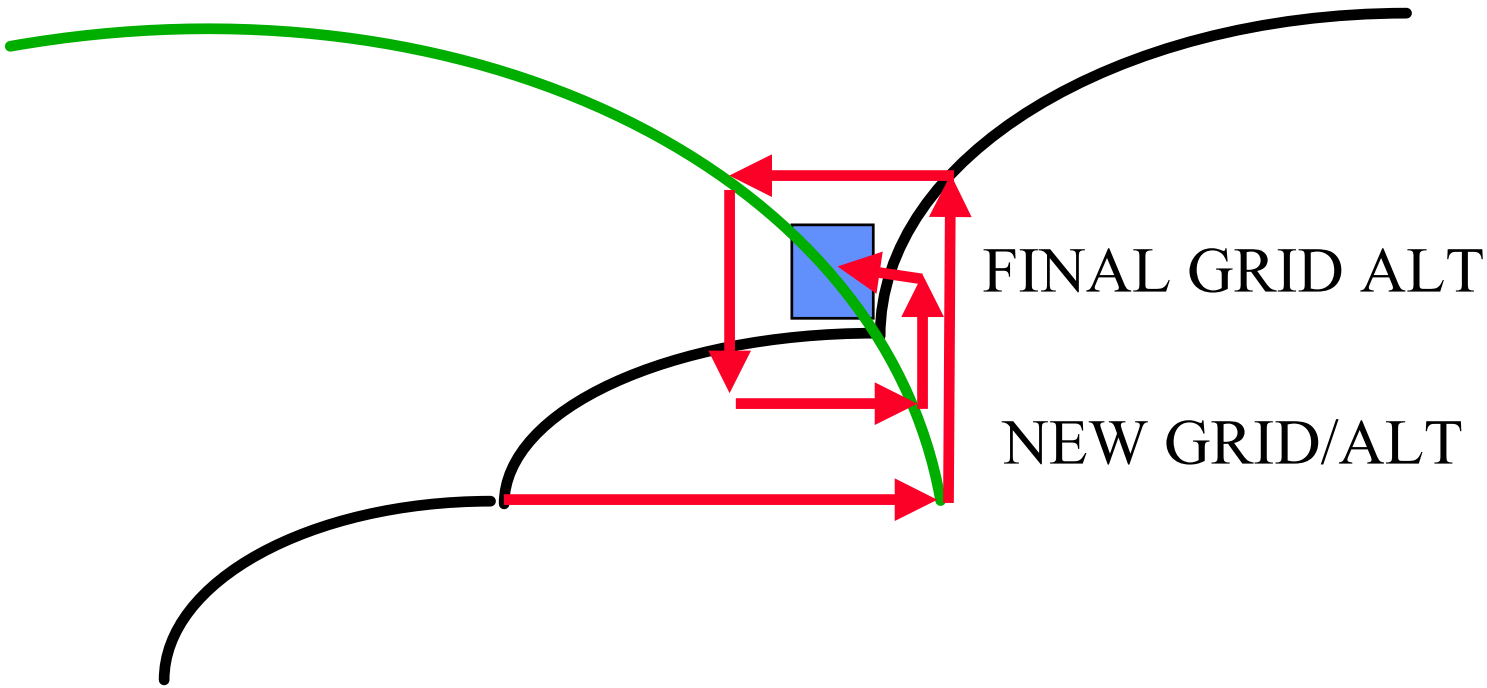
- VCO DETM'S ALT AT GRID DETERMINED
- COMPUTER ASSUMES TGT IS AT THIS ALTITUDE ALONG TRAJECTORY
- NEW GRID IS DETRMINED

REPLOT

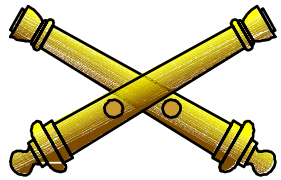


- VCO DETM'S ALT AT GRID DETERMINED
- COMPUTER ASSUMES TGT IS AT THIS ALTITUDE ALONG TRAJECTORY
- NEW GRID IS DETERMINED
- PROCEDURE REPEATED

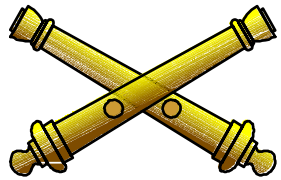
REPLOT



- REPLOT CONTINUES UNTIL A CONTOUR INTERVAL IS SPLIT
- GRID THEN DETERMINED IS ACCURATE
- PROCEDURES FUNCTIONS THROUGH SUCCESSIVE APPROXIMATION



SHELL/FUZE MIX FIRE MISSIONS

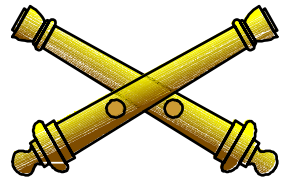


BCS COMPUTATIONS CAPABILITY

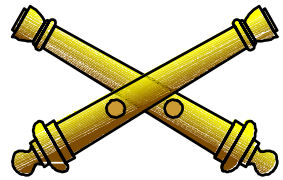
- BCS CAN COMPUTE FIRING DATA FOR MIXED SHELL/FUZE COMBINATIONS IN THE FIRE FOR EFFECT PHASE OF A FIRE MISSION.
- THE MAXIMUM NUMBER OF SHELL/FUZE COMBINATIONS AVAILABLE FOR ANY ONE FIRE MISSION IS 2 SHELLS & 2 FUZES FOR A TOTAL OF 2 SETS OF FIRING DATA.

BCS COMPUTATIONS CAPABILITY

- DURING FIRE MISSIONS THAT USE MIXED SHELL/FUZE COMBINATIONS, AFTER TRANSMITTING THE FIRST SET OF FIRING DATA TO THE GUNS, THE ONLY WAY TO RECALL THAT FIRING DATA IS TO MAKE AN ENTRY IN THE VOLCMD; FIELD.

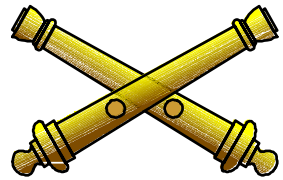


MASK VIOLATIONS



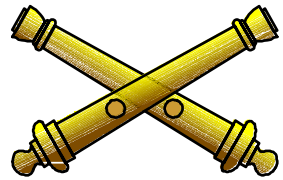
MASK VIOLATIONS

- CAN CLEAR VIOLATING HOWITZER FROM THE CURRENT MSN BY SELECTING HOWITZER NUMBER AND CLEAR KEY.
- HOWITZER WILL BE INCLUDED IN SUBSEQUENT CORRECTIONS FOR THE CURRENT MISSION.

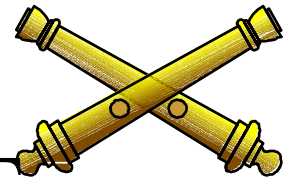


MASK VIOLATIONS

- CAN DELETE HOWITZER FROM THE CURRENT MISSION BY SELECTING HOWITZER NUMBER AND DELETE KEY.
- HOWITZERS WILL NOT BE INCLUDED IN SUBSEQUENT CORRECTIONS FOR THE CURRENT MISSION.

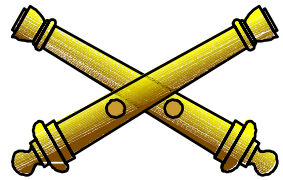


HIGH ANGLE



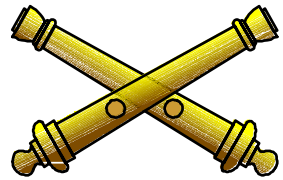
USES OF HIGH ANGLE

- ON TARGETS IN DEFILADE.
- WHEN FIRING OUT OF HEAVILY WOODED AREA.
- WHEN FIRING FROM BEHIND HILLS OR BUILDINGS.
- TO CLEAR INTERMEDIATE CREST WHICH ARE OCCUPIED BY FRIENDLY TROOPS.



CHARACTERISTICS OF HIGH ANGLE FIRE

- AS RANGE INCREASES - ELEVATION DECREASES.
- AS RANGE DECREASES - ELEVATION INCREASES.
- DRIFT IS LARGE AND VARIABLE.
- LARGE PROBABLE ERRORS ARE COMMON.

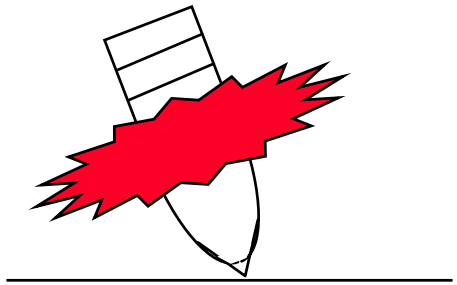


CHARACTERISTICS OF HIGH ANGLE FIRE

- HIGH MAXIMUM ORDINATE.
- LONG TIME OF FLIGHT NECESSITATES THE FDC TO SEND THE OBSERVER SPLASH.
- TRAJECTORY IS EASILY DETECTED BY ENEMY COUNTER BATTERY/COUNTER MORTAR RADAR.
- LARGE ANGLE OF FALL.

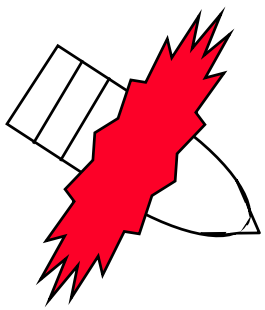
FUZE Q

LOW ANGLE

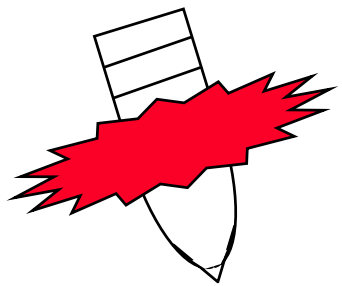


HIGH ANGLE

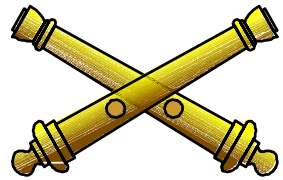
FUZE VT



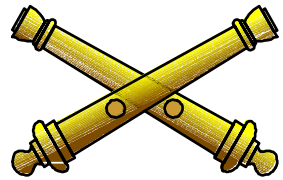
LOW ANGLE



HIGH ANGLE

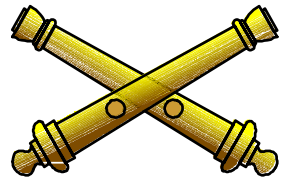


QUICK SMOKE



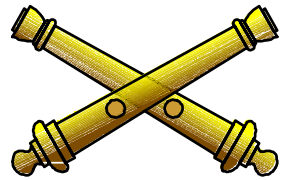
QUICK SMOKE

- OBSERVER TRANSMITS CFF IN THE FORM OF LMDIRT-
  - LENGTH OF SCREEN
  - MANUEVER-TGT DIRECTION
  - DIRECTION OF WIND
  - DURATION OF SCREEN
- FDO DETERMINES FIRE ORDER
- FDC DETERMINES FIRING DATA



CALL FOR FIRE

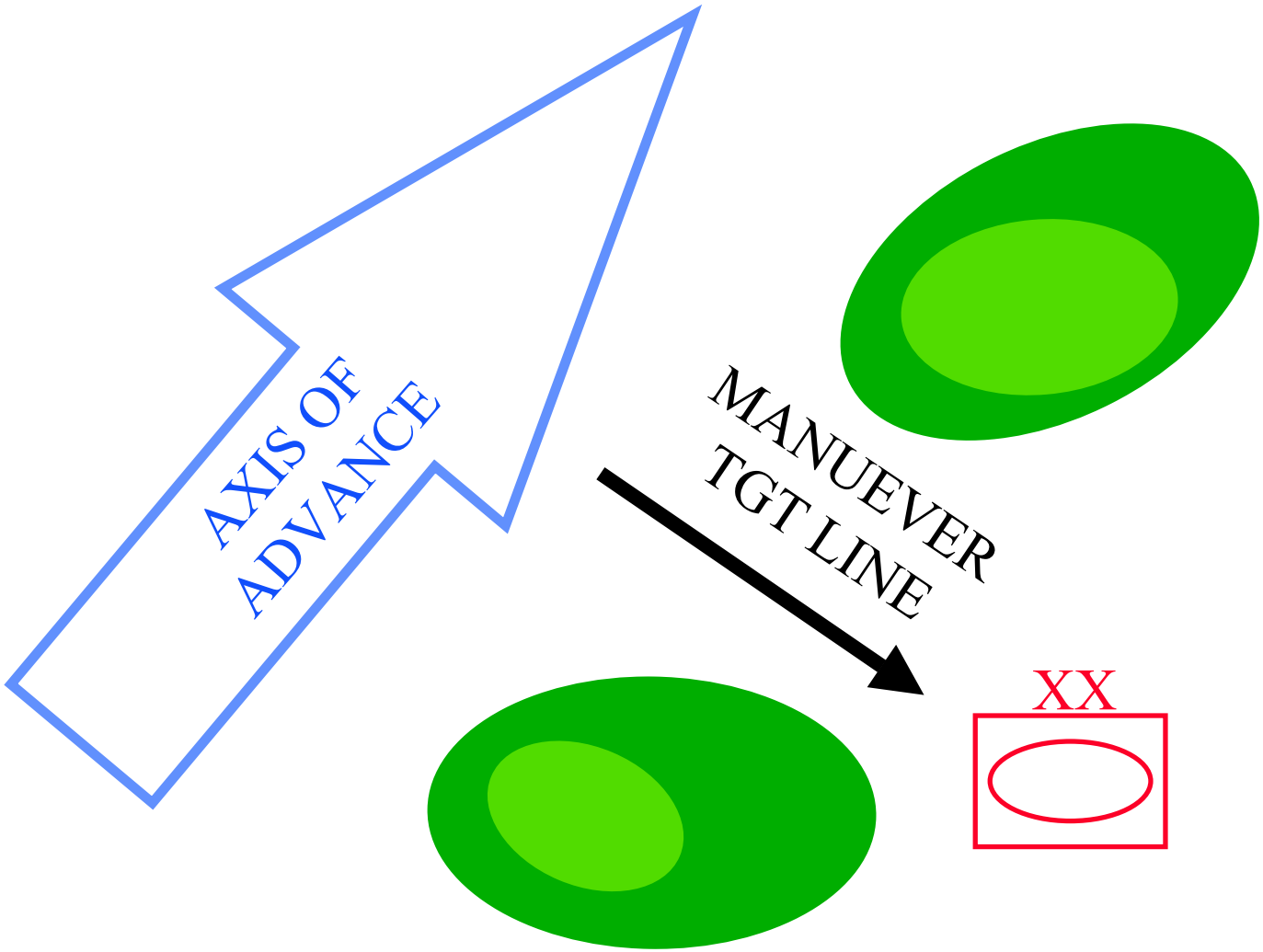
F21 dE H55 FFE $_{K}$
GRID 1450 4670 EST ALT 450$_{K}$
SCREEN MOVEMENT 250 M, DIR 1950,
TAILWIND 6 MIN $_{K}$



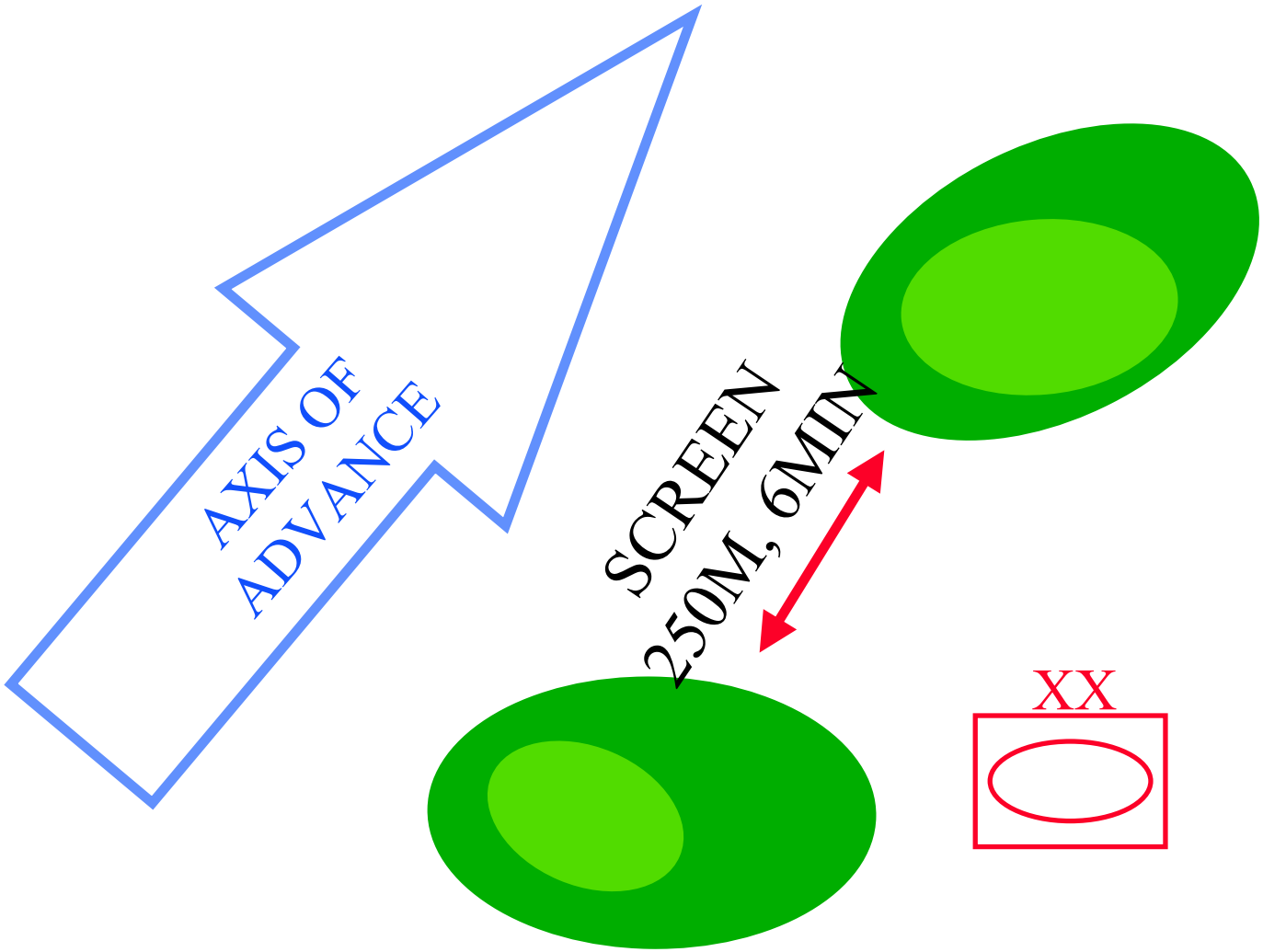
FDC DETERMINES

- RELATIVE HUMIDITY 50%
- WINDSPEED LINE 00 16 KNOTS
- LOCATION - GERMANY
- CURRENT CLOUD COVER

QUICK SMOKE



QUICK SMOKE

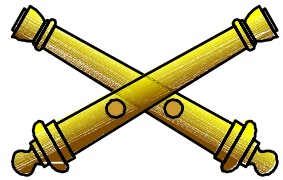


GUNNERY DEPARTMENT

M825 SMOKE FIRE ORDER

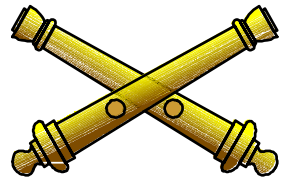
PASQUILL CATEGORY	D
SMOKE TABLE	D - 9
WINDSPEED	16

USAFAS



FROM SMOKE TABLE

R1	4
R2	2
FIRE INTERVAL	1.5



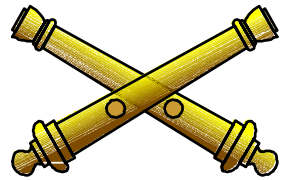
NUMBER OF VOLLEYS TO FIRE

$$\frac{\text{SMOKE DURATION}}{\text{FIRE INTERVAL}} = \text{TOTAL NUMBER OF VOLLEYS}$$

$$\frac{6}{1.5} = 4$$

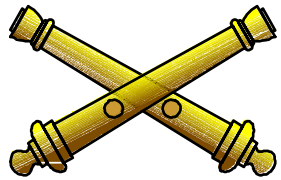
WHO WILL FIRE?

LEFT PLT		RIGHT PLT		
X	X	X	X	R1
		X	X	R2
		X	X	R2
		X	X	R2

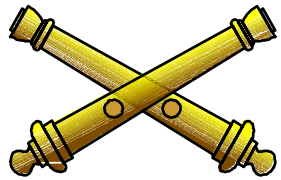


FIRE ORDER

RIGHT PLT 4 RDS, LEFT PLT 1 RD, BRAMC, SH M825



CHECKFIRING

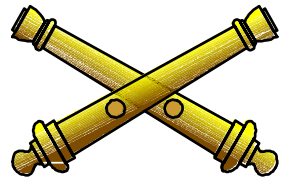


TYPES OF CHECKFIRING

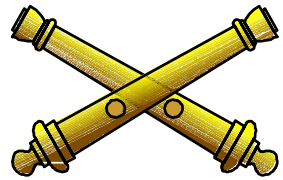
- LOCAL
  - PRESS CHECKFIRE SPECIAL ACTION KEY
  - FM;FOCMD: CKFIRE, CHKALL
- REMOTE
  - FM;FOCMD: CKFIRE, CHKALL
  - COMD:CF

CANCEL CHECKFIRING

- LOCAL
  - PRESS CANCEL CHECKFIRE SPECIAL ACTION KEY
  - FM;FOCMD
- REMOTE
  - FM;FOCMD
  - COMD:CC

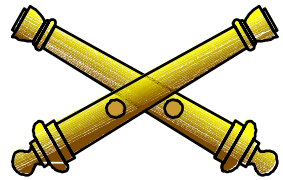


LASER MISSIONS



LASING EQUIPMENT

- G/VLLD (AN/TVQ - 2)
- MULE (AN/PAQ - 3)
- AN/GVS-5

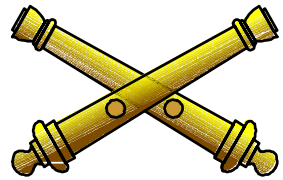


SIX TYPES OF LASER MISSIONS

- STATIONARY TARGET - STGT
- PREDICTED TARGET - PRED
- DRAW TARGET - DRAW/LAST
- RESECTION - RESC
- TRILATERATION - TRIL
- TRIANGULATION - TRIANG

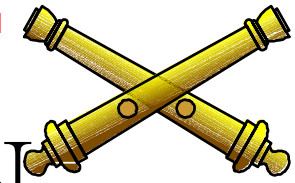
STATIONARY TARGET MISSION

- THE OBSERVER LASES THE TARGET, AND AN ADJUSTING ROUND IS FIRED.
- THE OBSERVER THEN LASES THE BURST OF THE ADJUSTING ROUND.
- THE BCS WILL COMPARE THE LASINGS OF THE TARGET AND THE BURST, AND DETERMINE A CORRECTION TO MOVE THE NEXT ROUND TO THE TARGET.



PREDICTED POINT

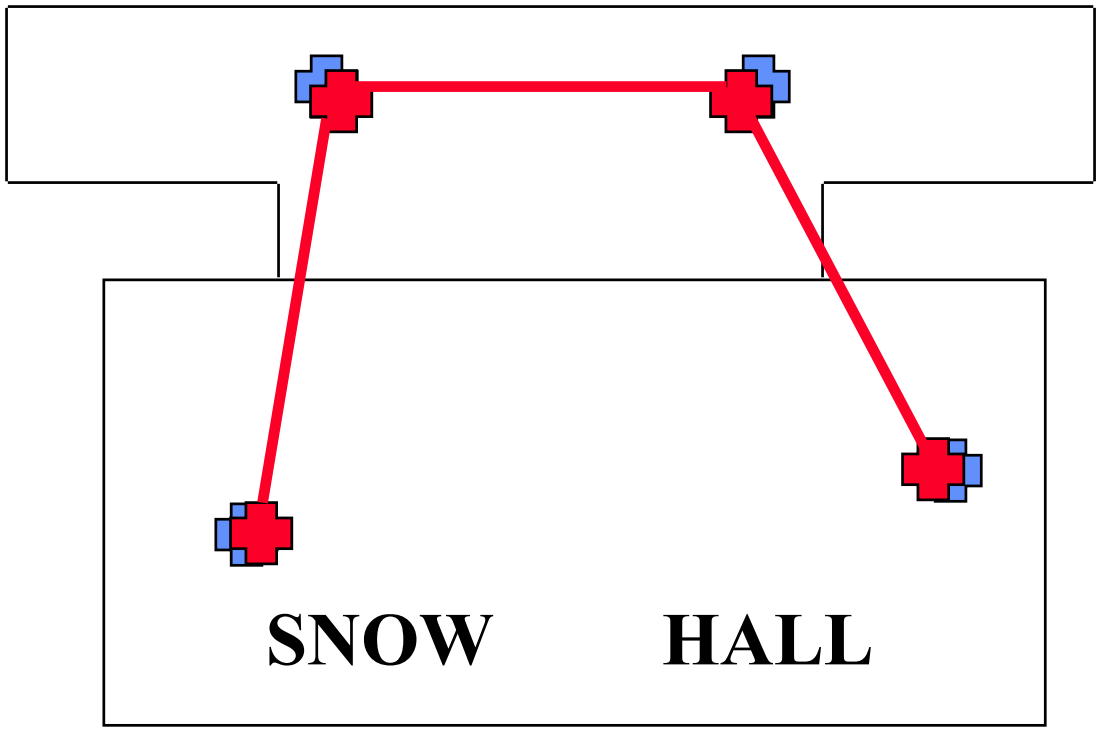
- OBSERVER LASES A POINT WHICH THE TARGET IS EXPECTED TO MOVE.
- THE MISSION IS REQUESTED AS AN AMC FFE MISSION.
- THE OBSERVER CONTROLS THE FIRING TO ENSURE THE SIMULTANEOUS ARRIVAL OF THE TARGET AND PROJECTILE AT THE PREDICTED POINT.



LASER DRAW MISSION

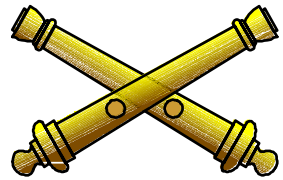
- THE OBSERVER IDENTIFIES AN IRREGULAR SHAPED TARGET BY LASING 2 TO 8 POINTS.
- THE LAST POINT MUST BE IDENTIFIED WITH LAST IN THE LAS FIELD.
- REQUIRES THE BCS TO HAVE AT LEAST 3 GUNS IN BCS; PIECES OPERATIONAL.

LASER DRAW MISSION



LASED POINTS

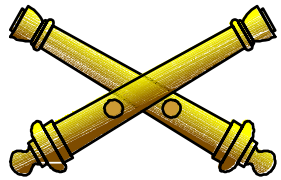
HOWITZER AIMPOINTS



OBSERVER SELF - LOCATION MISSIONS

TRILATERATION MISSION

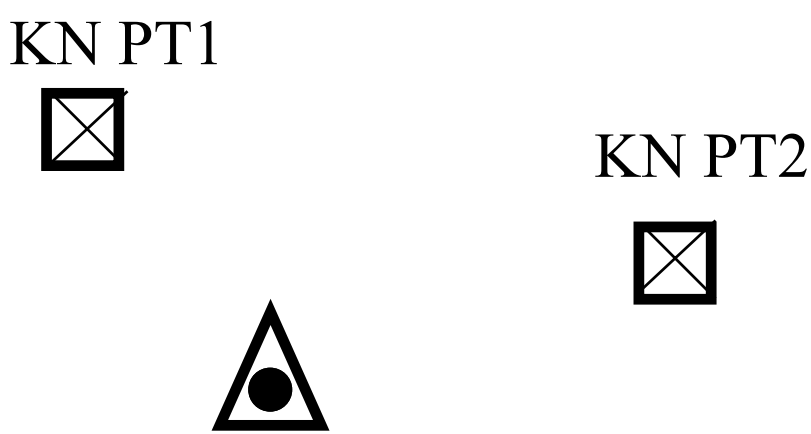
- THE FIRST POINT INPUT MUST BE ON THE OBSERVER'S LEFT.
- TWO KNOWN POINTS MUST BE RECORDED IN THE KN PT FILE AND IDENTIFIED PRIOR TO PROCESSING THE MISSION..



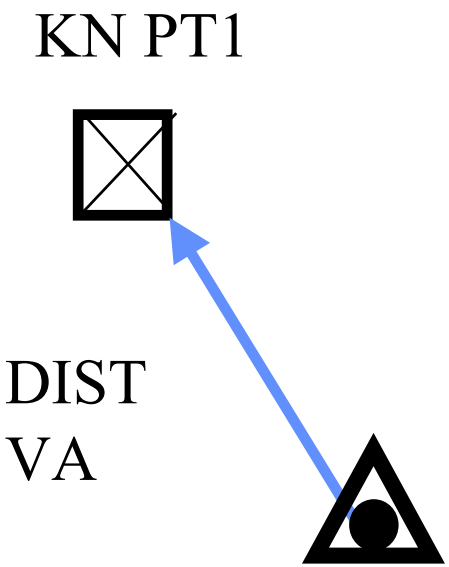
TRILATERATION MISSION

- THE BCS WILL USE THE OBSERVER-KNOWN POINT DISTANCES AND VERTICAL ANGLES TO DETERMINE THE OBSERVER'S LOCATION.
- THE BCS DOES NOT USE THE AZIMUTH THE OBSERVER SENDS; THEREFORE DIRECTIONAL CONTROL IS NOT REQUIRED

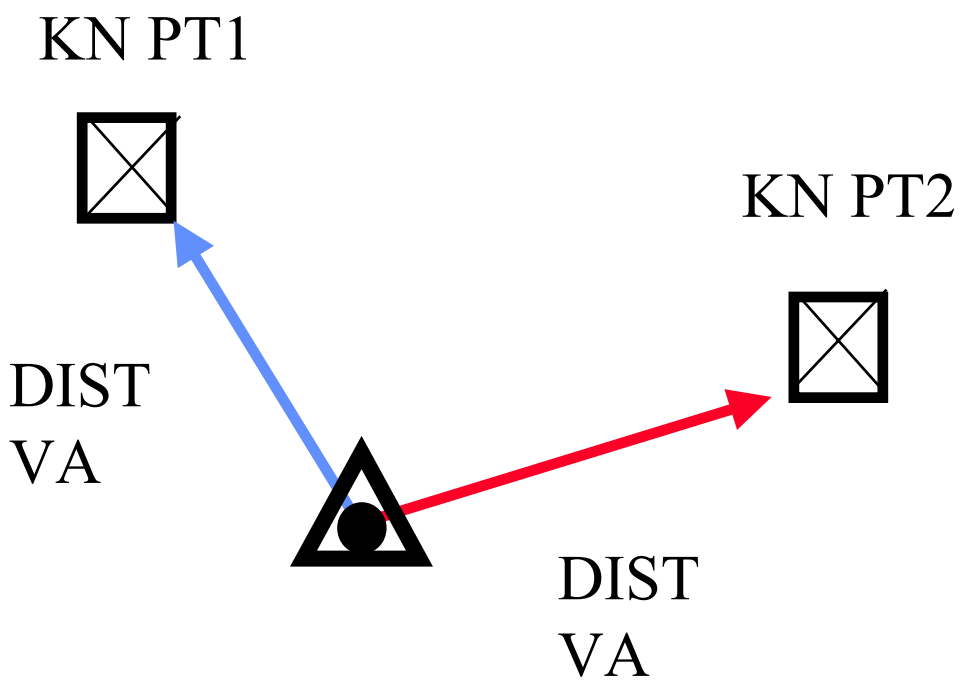
TRILATERATION



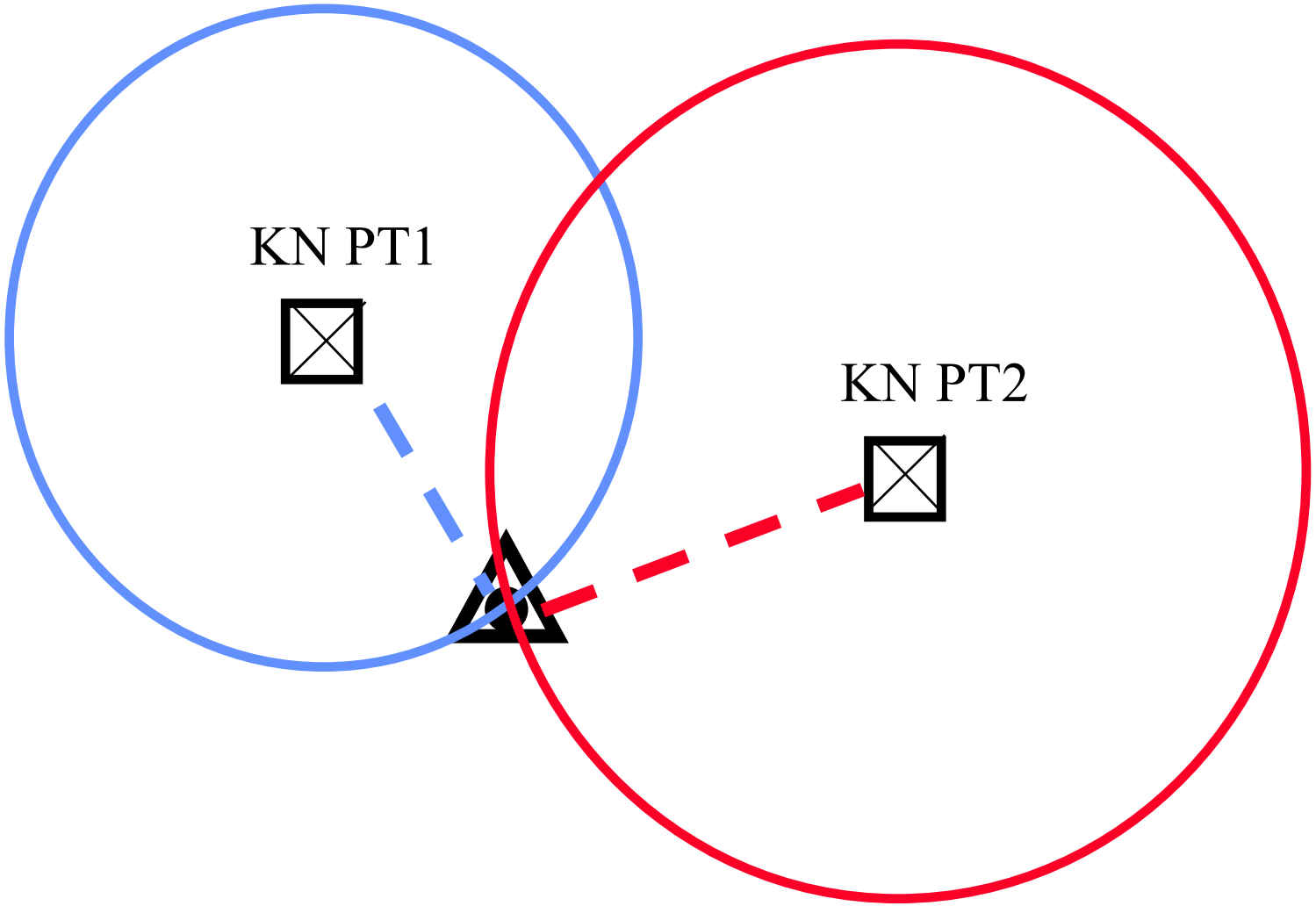
TRILATERATION

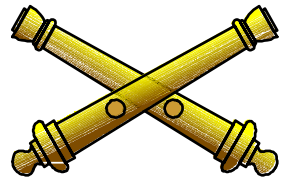


TRILATERATION



TRILATERATION





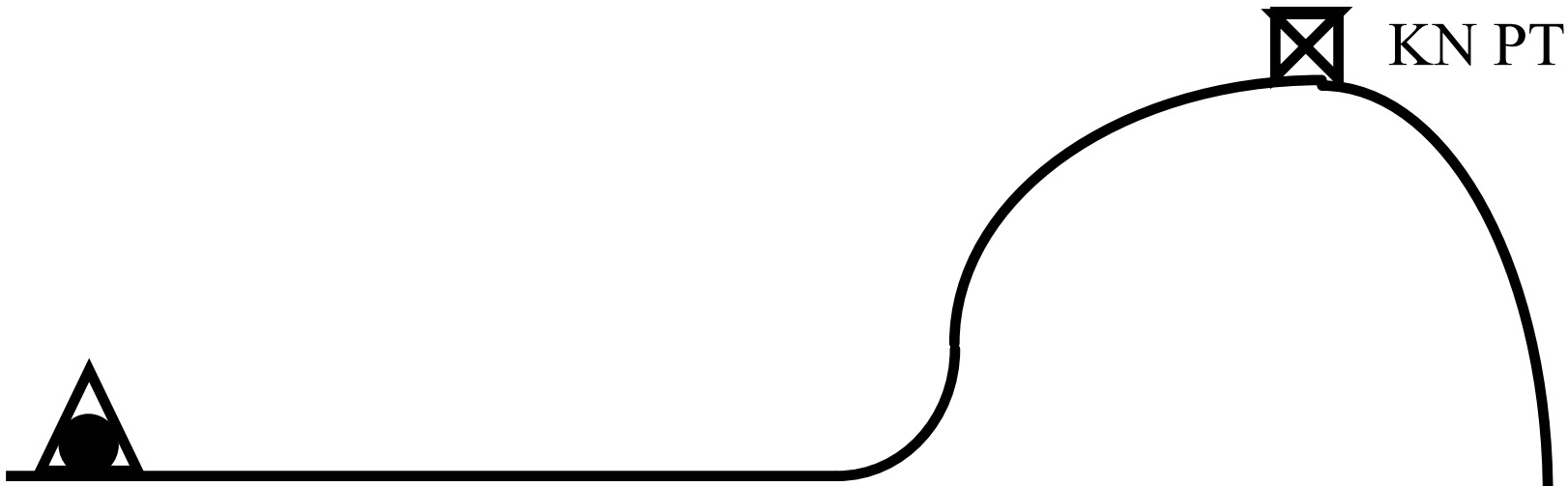
TRILATERATION

- INTERSECTION OF TWO CIRCLES IS OBS LOCATION.
- FM;OBCO AUTOMATICALLY UPDATED/STORED IN DATABASE.
- FM;OBCO DISPLAYED IS TRANSMITTED TO THE OBSERVER.
- SYS;PTM WITH DIRECTION TO KN PT ON LEFT DISPLAYED FOR TRANSMISSION TO THE OBS.

RESECTION MISSION

- ONE KNOWN POINT MUST BE RECORDED IN THE KN PT FILE AND IDENTIFIED PRIOR TO PROCESSING THE MISSION.
- THE BCS WILL USE THE OBSERVER KNOWN POINT DIRECTION, DISTANCE, AND VERTICAL ANGLE TO DETERMINE THE OBSERVER'S LOCATION.
- THE OBSERVER MUST HAVE DIRECTIONAL CONTROL.

RESECTION

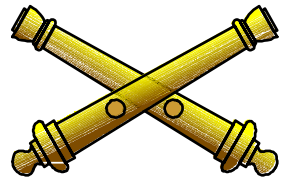


RESECTION

OBS LASES KN PT, TRANSMITS SPRT;LOC FORMAT TO FDC

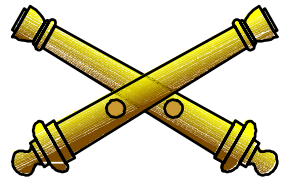
RESECTION

BCS DETERMINES AND USES INVERSE DIR, DIST, AND VA TO LOCATE OBS.



RESECTION

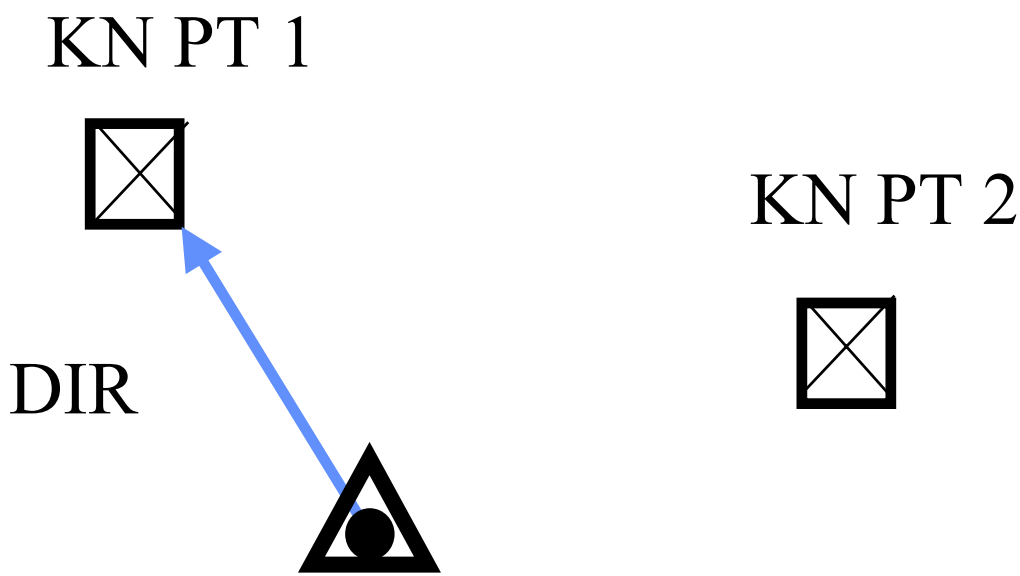
- BCS STORES/UPDATES FM;OBCO FOR OBSERVER.
- BCS DISPLAYS FM;OBCO FOR TRANSMISSION TO OBS.



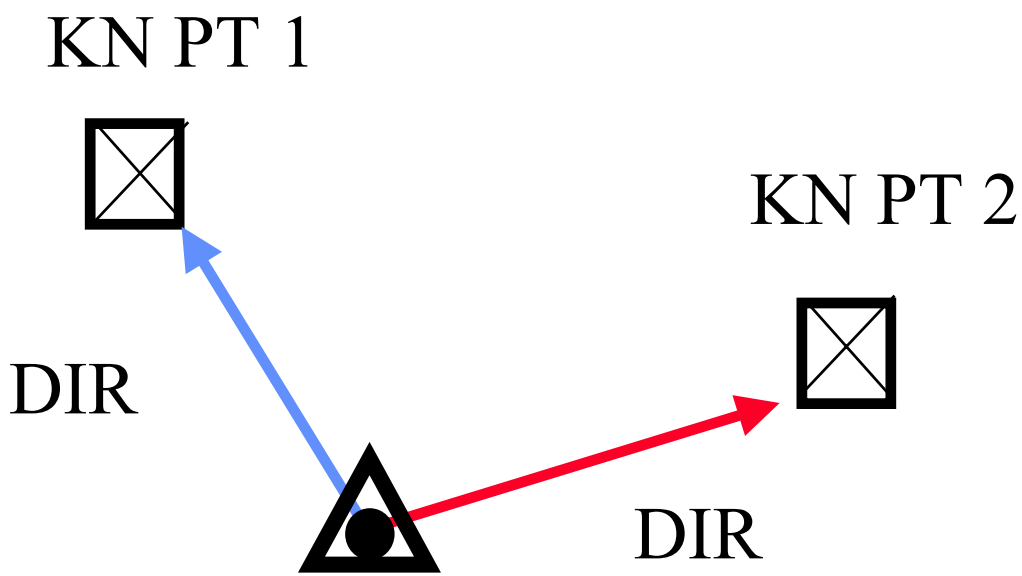
TRIANGULATION

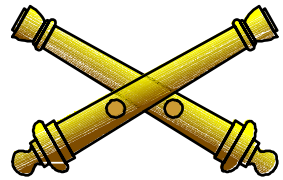
- OBS LASES KN PT ON LEFT.
- OBS LASES KN PT ON RIGHT.
- BCS USES DIRECTION ONLY TO DETERMINE OBS LOCATION.

TRIANGULATION



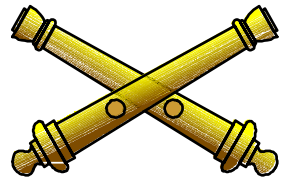
TRIANGULATION



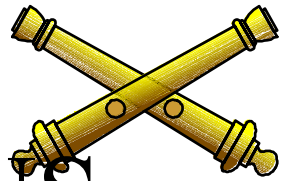


TRIANGULATION

- BCS STORES /UPDATES FM;OBCO FOR OBSERVER.
- BCS DISPLAYS FM;OBCO FOR TRANSMISSION TO OBS.
- BCS DISPLAYS ‘WARNING - VERIFY ALTITUDE WITH MAP SPOT’.



BCS PRIORITY MISSIONS

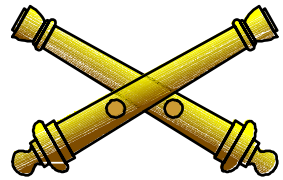


BCS PRIORITY MISSIONS

- BCS CAN STORE 4 PRIORITY MISSIONS IN MISSION BUFFERS 7 THROUGH 10 FOR A 155mm UNIT, OR 1 PRIORITY MISSION IN BUFFER 10 FOR 105mm UNIT.

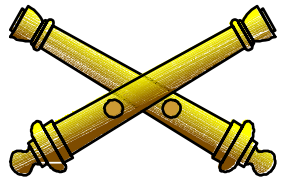
BCS WILL ASSIGN EITHER:

- ONE FPF AND THREE PRIORITY COPPERHEAD MISSIONS TO MISSION BUFFERS 7 THROUGH 10 (155mm)
- OR FOUR PRIORITY COPPERHEAD MISSIONS TO MISSION BUFFERS 7 THROUGH 10.



FIRING PRIORITY MISSIONS

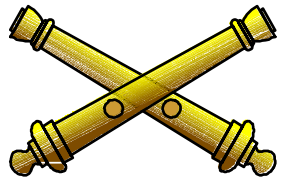
- A PRIORITY MISSION CAN BE FIRED BY:
  - AN OBSERVER USING THE FM;QF MESSAGE FORMAT (REMOTE).
  - BCS OPERATOR USING THE FPF SPECIAL ACTION KEY, F7 (LOCAL).



UPDATING PRIORITY MISSIONS

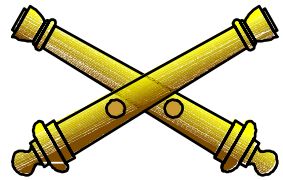
IF CONDITIONS CHANGE FPF DATA MUST BE UPDATED.

- ENTER DATA WHICH HAS CHANGED INTO DATA BASE:
  - MET
  - PROPELLANT TEMPERATURE
  - MVV'S
  - UPDATED SURVEY INFORMATION
  - REGISTRATION CORRECTIONS
  - CHANGE ASSOCIATED OBSERVER

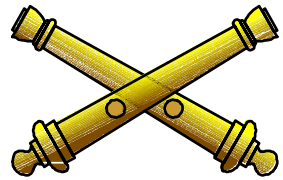


UPDATING PRIORITY MISSIONS

- ENABLE DATA. COMPLETE THE APPROPRIATE FORMATS AND EXECUTE.
- RECALL GUN DATA FROM PRIORITY MISSION BUFFER.
- EXECUTE RELATED MESSAGE
  - GUN DATA IS DISPLAYED WHICH CORRECTS FOR CURRENT NONSTANDARD CONDITIONS
- TRANSMIT UPDATED GUN ORDERS.

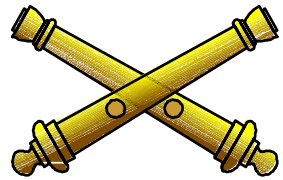


M712
COPPERHEAD



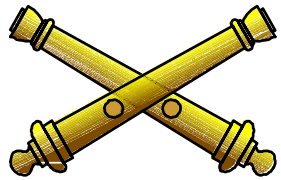
COPPERHEAD

A CANNON-LAUNCHED, LASER-GUIDED, HIGH EXPLOSIVE, ANTITANK 155MM PROJECTILE. IT WILL TRAVEL ALONG A SHAPED TRAJECTORY UNTIL IT SEEKS AND ACQUIRES A DESIGNATOR'S CODED LASER ENERGY AS IT IS REFLECTED FROM A TARGET.



COPPERHEAD MISSION PROCESSING

- CAN BE PROCESSED AS EITHER A TARGET OF OPPORTUNITY OR A PRIORITY MISSION.
- BCS WILL EXAMINE THE OBSERVER CLOUD HEIGHT AND VISIBILITY FIELDS TO DETERMINE IF THE MISSION CAN BE PROCESSED.



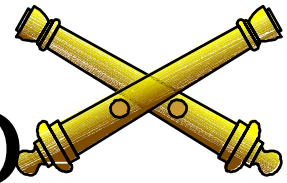
COPPERHEAD MISSION PROCESSING (CON'T)

- THE NUMBER OF ROUNDS TO BE FIRED WILL EQUAL THE ENTRY IN THE STR: FIELD. IF STR: FIELD IS BLANK OR 0, THE RDS: FIELD WILL DEFAULT TO 1, AND ONLY 1 HOWITZER WILL BE ASSIGNED THE MISSION.

COPPERHEAD MISSION PROCESSING (CON'T)

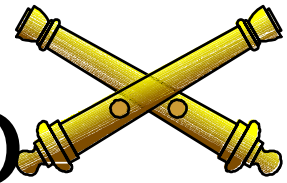
- THE TOTAL NUMBER OF ROUNDS FIRED WILL NOT BE GREATER THAN SIX AND THE MAXIMUM NUMBER OF HOWITZERS ASSIGNED TO THE MISSION WILL BE TWO.

ENGAGEMENT COMMAND

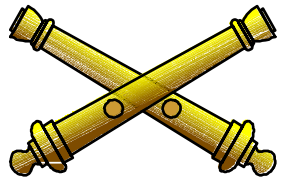


- LCU OPERATOR DISPLAYS THE FM;FOCMD: SPLASH MESSAGE. TYPE OVER THE COMMAND SPLASH WITH THE COMMAND DESIG.
- APPROXIMATELY 20 SECONDS PRIOR TO THE PROJECTILE REACHING THE TARGET, THE FM;FOCMD: DESIG MESSAGE IS TRANSMITTED TO THE OBSERVER.

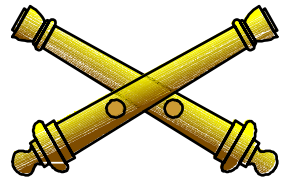
ENGAGEMENT COMMAND



- THE COPPERHEAD PROJECTILE REQUIRES 13 SECONDS OF ACQUIRED REFLECTED LASER ENERGY TO BE ABLE TO SUCCESSFULLY SEEK THE TARGET.

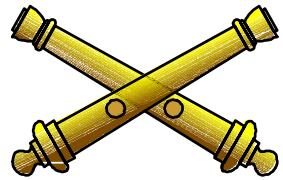


ILLUMINATION



USES OF ILLUMINATION

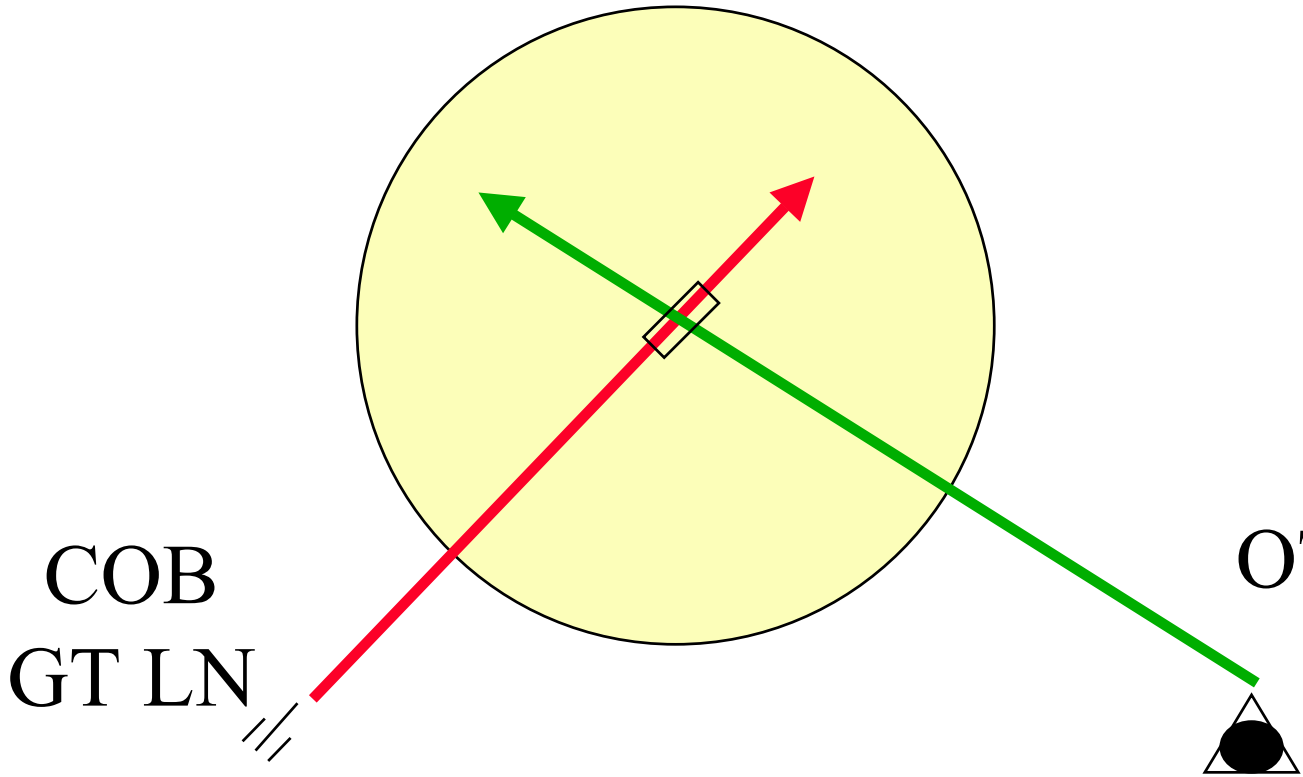
- ILLUMINATE AREAS OF SUSPECTED ENEMY MOVEMENTS.
- PROVIDE ILLUMINATION FOR NIGHT ADJUSTMENT OR SURVEILLANCE OF ARTILLERY FIRE BY OBSERVERS.
- HARASS ENEMY POSITIONS OR INSTALLATIONS.



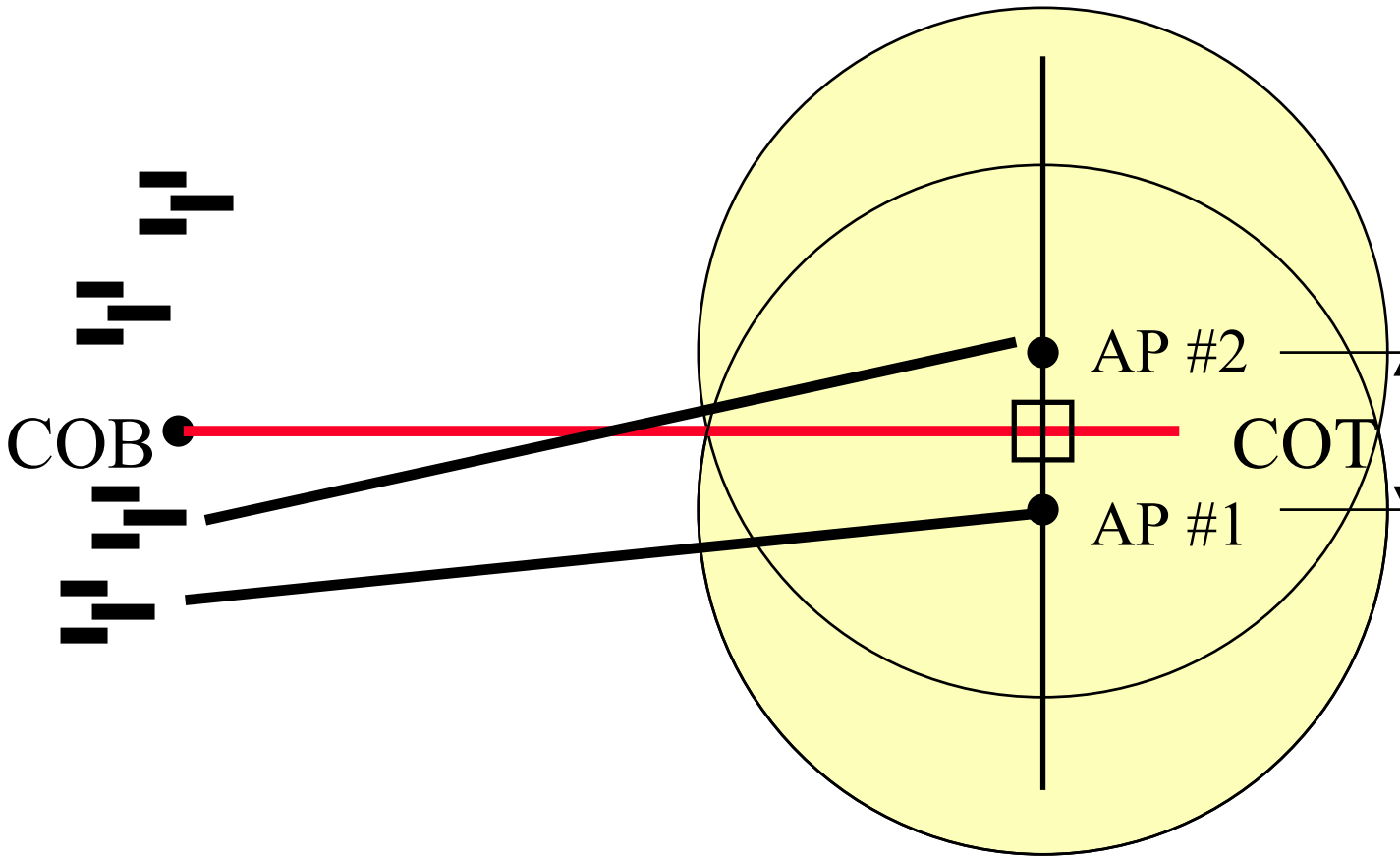
USES OF ILLUMINATION

- PROVIDE DIRECTION TO FRIENDLY TROOPS FOR ATTACKS OR PATROL ACTIVITIES.
- GUIDE LOW-LEVEL TACTICAL BOMBERS TO IMPORTANT TARGETS THAT ARE WITHIN ARTILLERY RANGE.

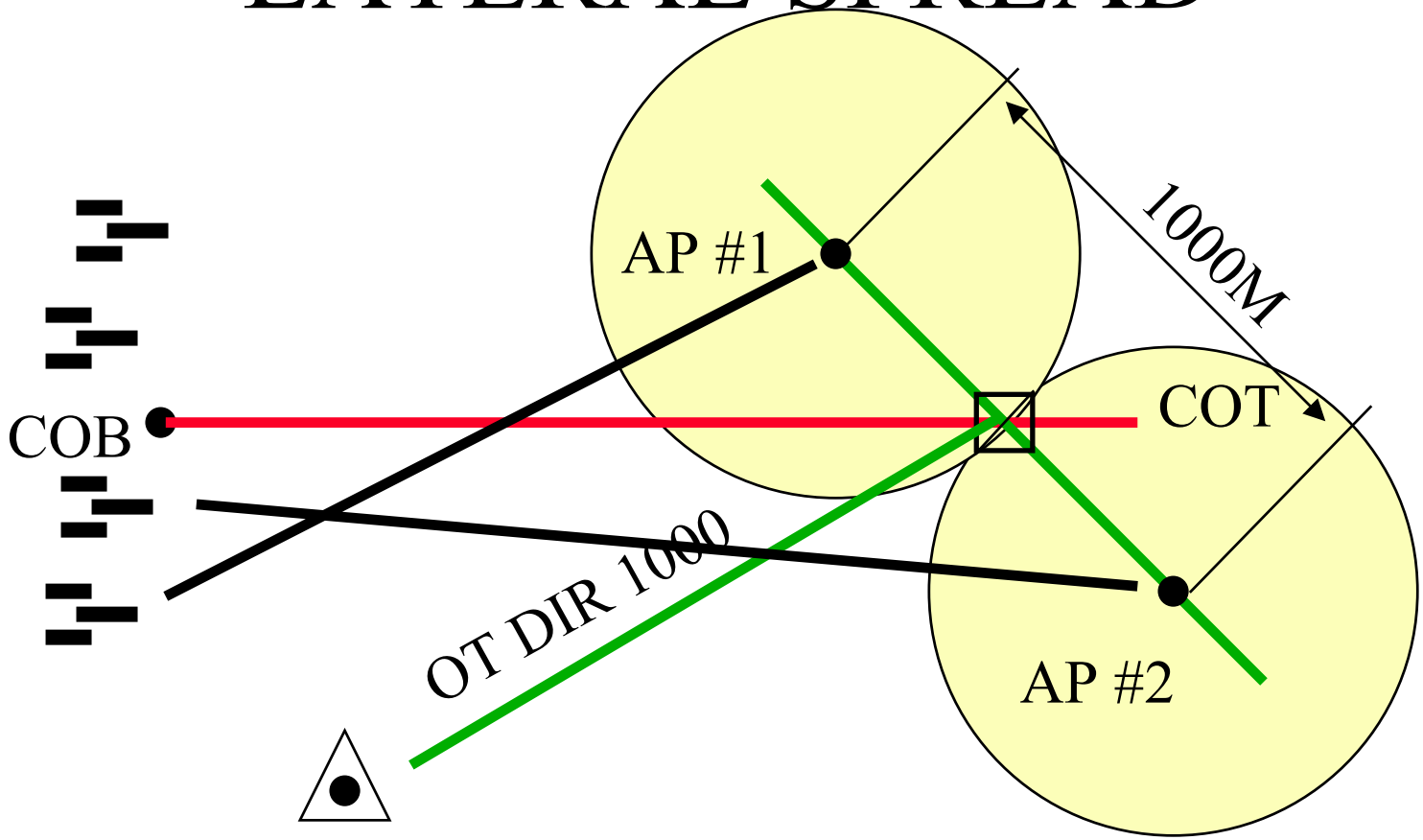
ONE GUN ILLUMINATION



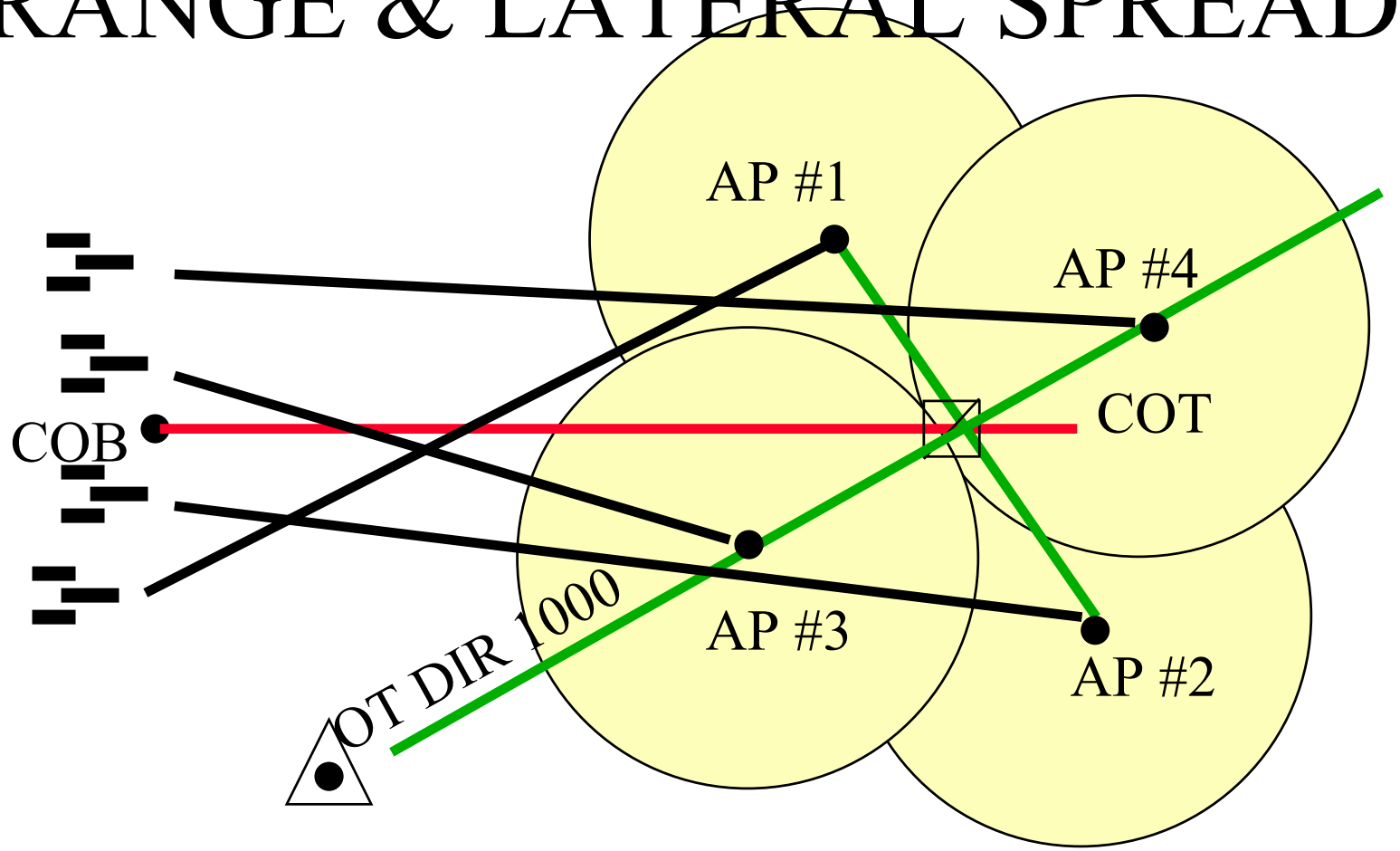
TWO GUN ILLUMINATION

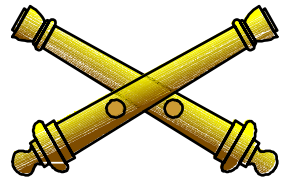


TWO GUN ILLUMINATION LATERAL SPREAD



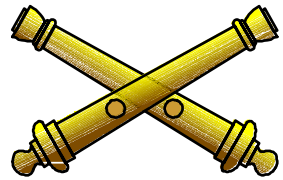
FOUR GUN ILLUMINATION RANGE & LATERAL SPREAD





FDC CONTROLLED COORDINATED ILLUMINATION

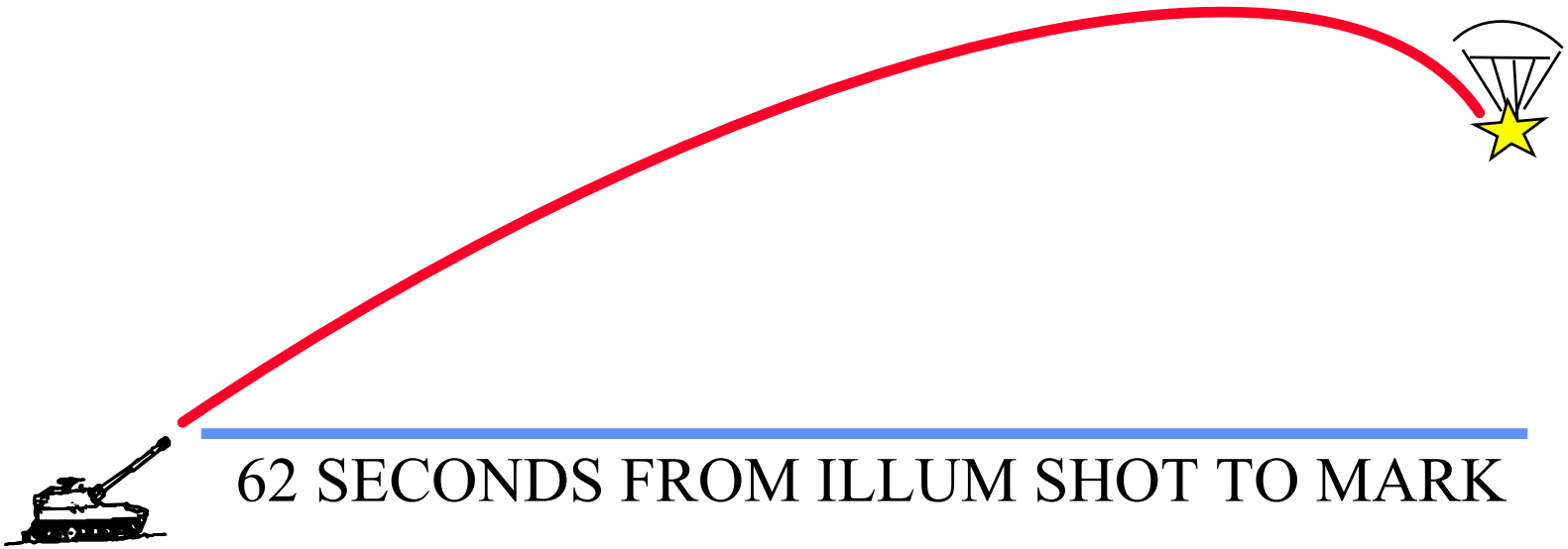
- THE OBSERVER WILL TRANSMIT COORDINATED ILLUM TO THE FDC.
- THE OBSERVER WILL TRANSMIT ILLUMINATION MARK AT THE TIME THE TARGET IS BEST ILLUMINATED.



FDC CONTROLLED COORDINATED ILLUMINATION

- THE FDC TIMES THE INTERVAL BETWEEN ACTUAL FIRING OF ROUNDS AND TRANSMISSION OF ILLUMINATION MARK.
- COMPARING THIS INTERVAL TO THE HE TOF, THE FDC CONTROLS FIRING SO HE ROUNDS IMPACT AT TIME OF MAXIMUM ILLUMINATION.

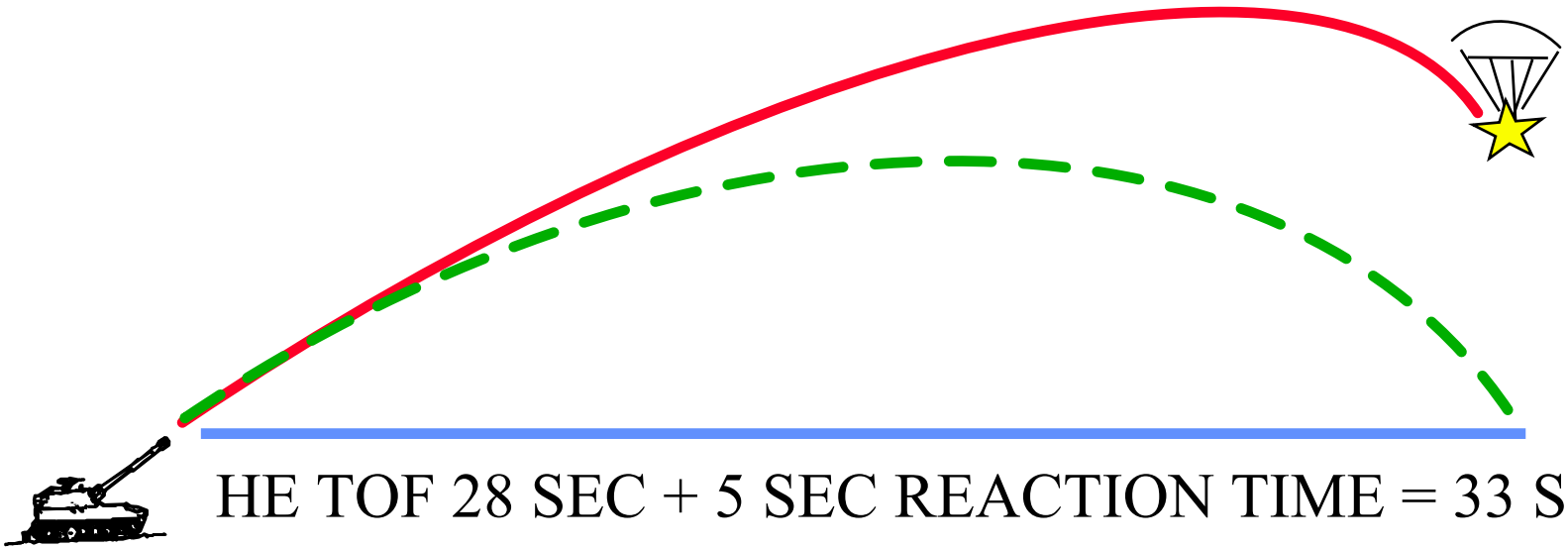
COORDINATED ILLUMINATION



62 SECONDS FROM ILLUM SHOT TO MARK

- FDC FIRES ILLUM AND STARTS TIMER
- OBS TRANSMITS “ILLUMINATION MARK” WHEN TGT AREA IS BEST ILLUMINATED
- TOTAL ELAPSED TIME IS MARK TIME

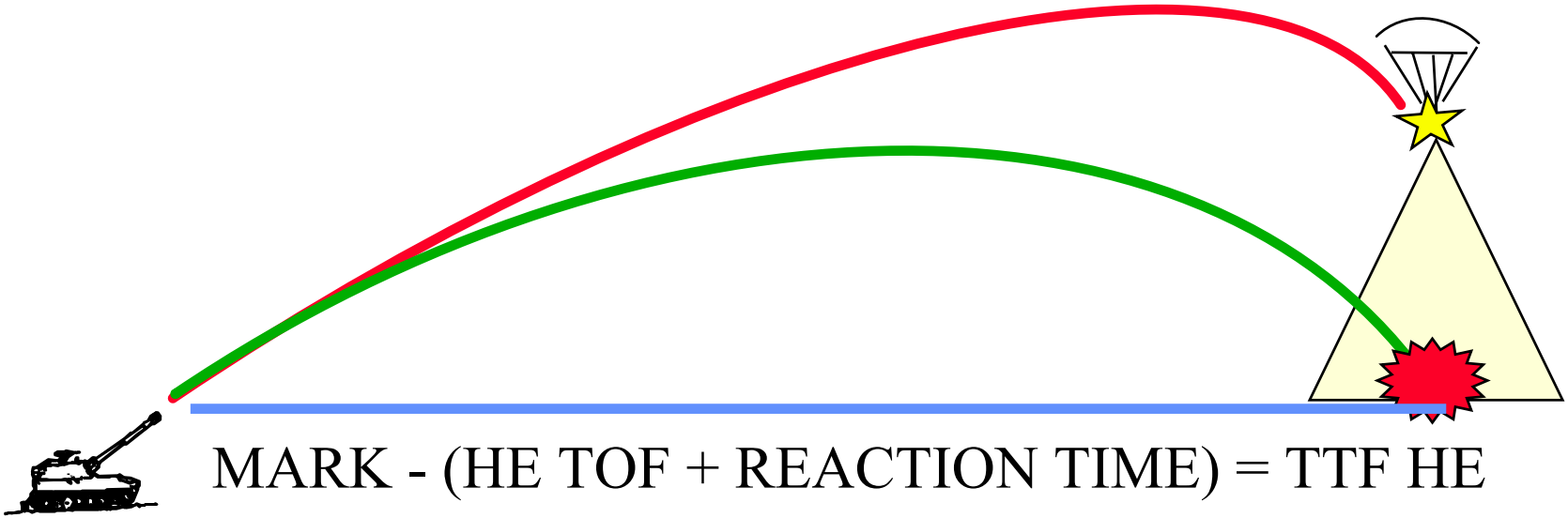
COORDINATED ILLUMINATION



HE TOF 28 SEC + 5 SEC REACTION TIME = 33 SEC

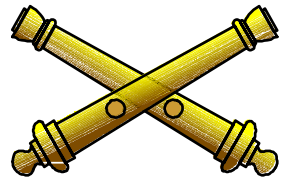
- OBS TRANSMITS HE CALL FOR FIRE
- FDC DETERMINES HE TIME OF FLIGHT AND ADDS 5 SEC REACTION TIME
- FDC SUBTRACTS HE TOF + 5 SECS FROM MARK TIME TO DETERMINE TIME TO FIRE (TTF) HE

COORDINATED ILLUMINATION



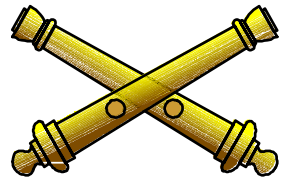
MARK - (HE TOF + REACTION TIME) = TTF HE
62 SEC - 33 SEC = 29 SEC

- FDC FIRES ILLUM, STARTS TIMER
- FDC FIRES HE AFTER DETERMINED AMOUNT OF TIME (TTF) HAS ELAPSED
- HE BURSTS UNDER OPTIMUM ILLUM

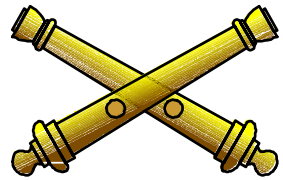


CONTINUOUS ILLUMINATION

- THE OBSERVER MAY REQUEST CONTINUOUS ILLUMINATION
- FDC WILL FIRE ILLUMINATION CONTINUOUSLY (RATE OF FIRE DEPENDS UPON PROJECTILE) WHILE THE OBSERVER ADJUSTS THE HE.
- THIS METHOD EXPENDS A LARGE QUANTITY OF AMMO AND IS THE LEAST DESIRABLE METHOD.

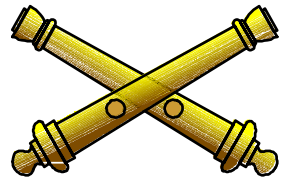


FIRE PLANS



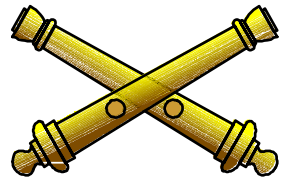
FIRE PLANS

- LCU CAN STORE FOUR FIRE PLANS, WITH A TOTAL OF 78 TARGETS.
- THE FIRE PLANS CAN BE EITHER SCHEDULED OR ON-CALL.
- FASCAM TARGET AIM POINTS CAN BE STORED IN ALL 4 OF THE FIRE PLANS.



FIRE PLANS

- CAN BE INPUT LOCALLY AS INDIVIDUAL TGTS UTILIZING NON-NUCLEAR FIRE PLAN; CALL FOR FIRE MESSAGE FORMAT (NNFP;CFF:).
- CAN BE TRANSMITTED FROM BN FDC AND ENTERED AS A WHOLE PLAN (SYSTEM INDEX, 7 “FIRE PLAN GROUP ENTRY,” EXECUTE).

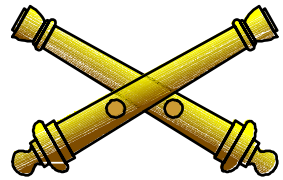


FIRE PLAN SILVER

- PLAN: SILVER H-HOUR: ON-CALL

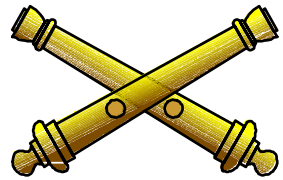
TGT	H	VOL	SH/FZ	PTF	CORD/ALT/GZ
BC1001	-7	2	HE/VT	BTRY	142/513 465 +33
BC1002	-3	4	HE/VT	BTRY	144/514 465 +33
BC1006	H	1	WP/Q	BTRY	139/519 430 +33
BC1108	+2	1	ICM	BTRY	138/524 445 +33
BC1011	+5	1	ICM	BTRY	137/520 430 +33

USAFAS



FIRE PLANS

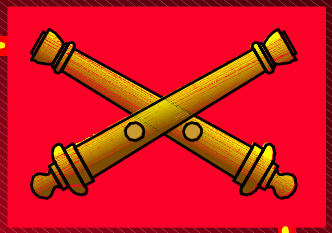
- TO SET OR CHANGE H-HOUR, AND DELETE TARGETS OR FIRE PLANS USE THE BCS;COMD MESSAGE FORMAT
- TO FIRE A TARGET BEFORE H-HOUR, PLACE AN “X” IN FIRE REQUEST INDICATOR (FR:_) FIELD OF NNFP;CFF FORMAT AND EXECUTE



FIRE PLANS

- FM;CFF:O GENERATED 10 MINUTES BEFORE TIME TO FIRE
  - TIME TO FIRE EQUALS H-HOUR PLUS H, MINUS TIME OF FLIGHT PLUS 5 SECOND REACTION TIME
- FM;CFF:O PLACED IN INPUT QUEUE FOR OPERATOR EXECUTION, PROCESSING, AND FIRING
- CYCLE THROUGH ALL PLAN TARGETS IN THIS MANNER

GUNNERY DEPARTMENT



THE KING OF BATTLE

USAFAS